# ME 2030 HW8

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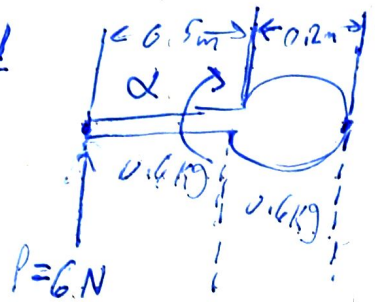
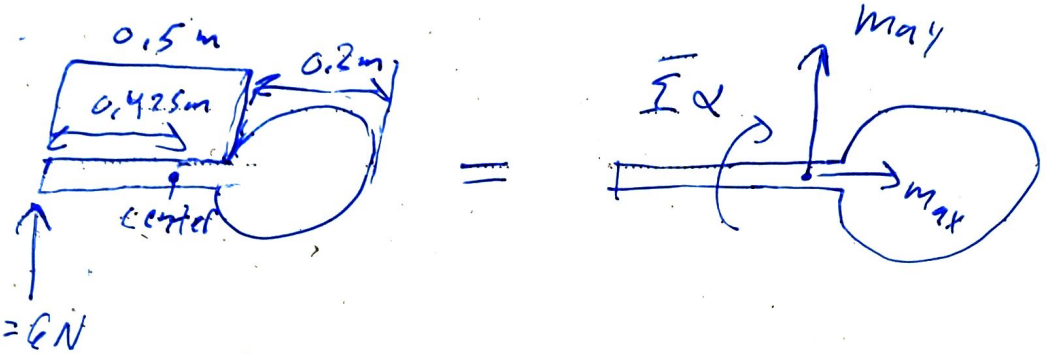



$= \frac{0.6(0.25)+0.6(0.6)}{0.6+0.6} = 0.425\,m$




$\bar{I}_1 = \frac{1}{12}(0.6)(0.5)^2 = 0.0125 + 0.6(0.175)^2 = 0.030875$

$\bar{I}_2 = \frac{1}{2}(0.6)(0.1)^2 = 0.003 + 0.6(0.175)^2 = 0.021375$

$\bar{I} = 0.05225$

$\Sigma F_x$: $0 = 1.2\,a_x$, $a_x = 0$

$\Sigma F_y$: $6 = 1.2\,a_y \rightarrow \underline{a_y = 5\,m/s^2}$

$\Sigma M_c$: $-6(0.425) = 0.05225 \cdot \alpha$, $\alpha = \underline{-48.8\,rad/s}$ ↻

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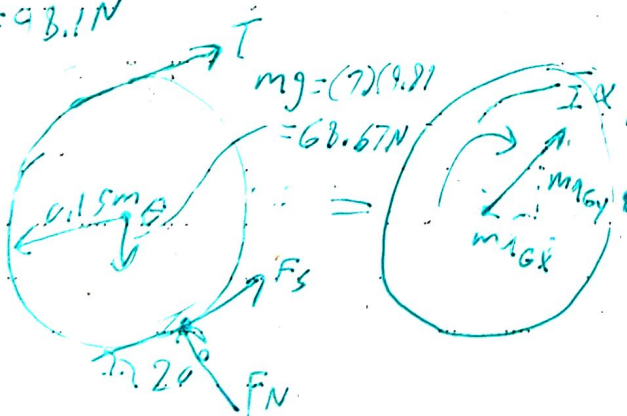
$\Sigma F_y$: $T - 98.1 = 10(2a_G)$ ↻ $\alpha \cdot r$

$T - 98.1 = 10(2(\alpha \cdot 0.15))$

$a_G = \alpha \cdot r \rightarrow \alpha = \frac{a_G}{r}$

$\bar{I} = \frac{1}{2}mr^2 = \frac{1}{2}(7)(0.15)^2 = 0.07875$

$\Sigma M_N$: $63.67(0.15)\sin(20) - T(0.3) = 0.07875(\alpha)$




$\uparrow \Sigma F_y$: $F_N - 68.67\cos 20 = 0$, $F_N = 64.53N$

$\leftarrow \Sigma F_x$: $T + M_s \cdot F_N - 63.67(0.15) = 7(\alpha \cdot 0.$

$T - 98.1 = 16(2(\alpha \cdot 1.5)$

$T - 98.1 = 30(2\alpha)$

$T = 60\alpha + 98.1 \quad T = 11.1$

$63.67(0.15)\sin(20) - 0.3T = 0.07875(\alpha)$

$63.67(0.15)\sin(20) - 0.3(60\alpha + 98.1) = 0.07875(\alpha)$

$3.2665 - 18\alpha - 29.43 = 0.07875\alpha$

$-26.1635 = 18.07875\alpha \rightarrow \alpha = -1.45 \text{ rad/s}^2$

$11.1 + \mu_s \cdot 64.53 - 63.67(0.15) = 7(-1.45 \cdot 0.15)$

$\mu_s \cdot 64.53 = -3.072$

$\mu_s = -0.0476$

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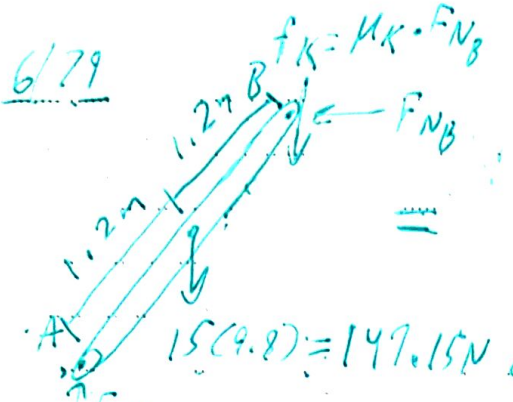
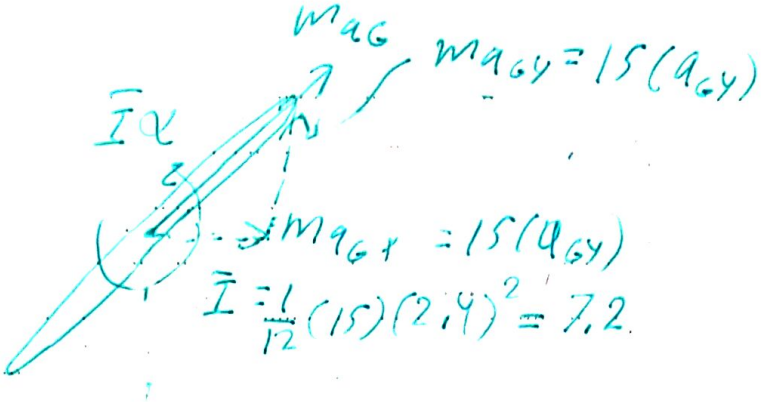
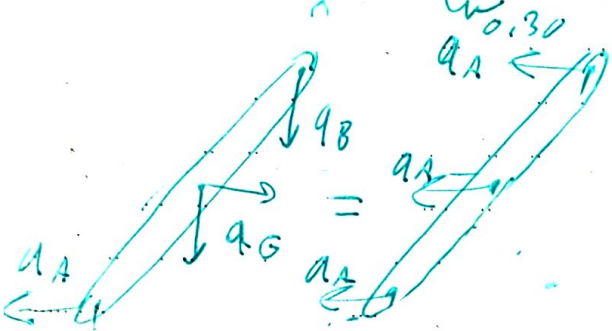


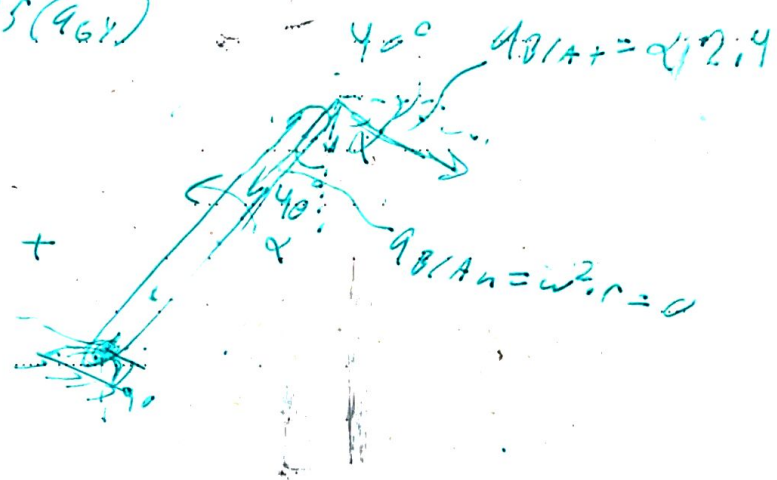




$\Sigma M_+: 147.15(1.2) - F_{N_A}(2.4) = 7.2\alpha$

$\Sigma F_x: -F_{N_B} = 15(a_{G_x})$

$\Sigma F_y: F_{N_A} - 147.15 - \mu_K \cdot F_{N_B} = 15(a_{G_y})$

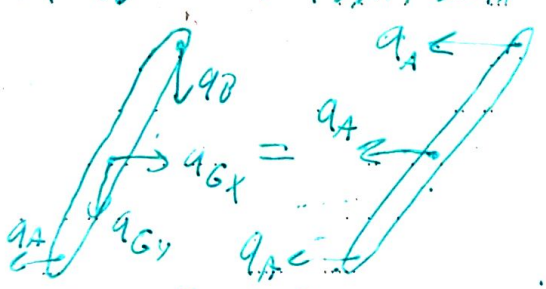


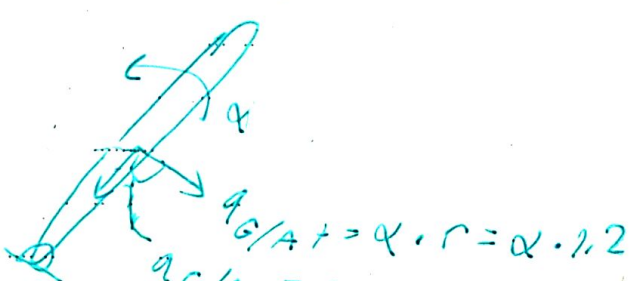




$a_B = a_A + a_{B/A}$

X: $0 = a_A + a_{B/A_t}\cos\theta \rightarrow a_A = -a_{B/A_t}\cdot\cos\theta$

Y: $-a_B = 0 + a_{B/A_t}\sin\theta \rightarrow a_B = -a_{B/A_t}\sin\theta$




$a_G = a_G + a_{G/A}$

X: $a_{G_x} = 0 + a_{G/A_t}\sin\theta \rightarrow a_{G_x} = a_{G/A_t}\sin\theta$

Y: $a_{G_y} = 0 + a_{G/A_t}\cos\theta \rightarrow a_{G_y} = a_{G/A_t}\cos\theta$

$a_A = -(\alpha \cdot 2.4)\cos\theta \qquad a_{G_x} = (\alpha \cdot 1.2)\sin\theta$

$a_B = -(\alpha \cdot 2.4)\sin\theta \qquad a_{G_y} = (\alpha \cdot 1.2)\cos\theta$

$\rightarrow$ $a_A = -8.12\,mm/s^2$

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$$T_1 + V_{g_1} + V_{e_1} + U_{1-2} = T_2 + V_{g_2} + V_{e_2}$$

$$T_1 = \frac{1}{2} m V_1^2 + \frac{1}{2} m k^2 \qquad I_o$$
$$= \tfrac{1}{2}(8)(0.3)^2 + \tfrac{1}{2}(12)(0.21)^2$$
$$= 0.62$$

$$U_{1-2} = (8)(9.81)(1.5) = 94.176$$

$$T_2 = \tfrac{1}{2} m V_2^2 + \tfrac{1}{2} m k^2$$
$$T_2 = \tfrac{1}{2}(8) V_2^2 + \tfrac{1}{2}(8)(0.4)^2$$
$$T_2 = 4.35 V_2^2 + 0.176$$

$$T_1 + U_{1-2} = T_2$$
$$0.62 + 94.17 = 4.35 V_2^2 + 0.176$$
$$V_2 = 4.76 \text{ m/s}$$

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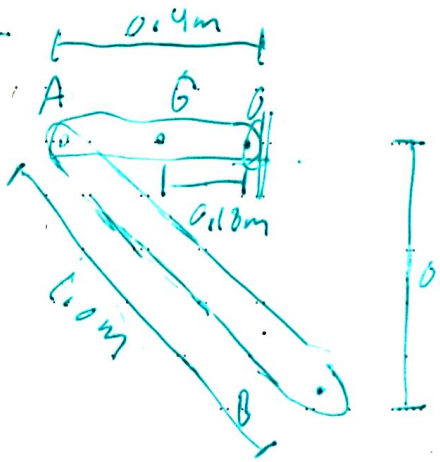


$$V_{g_A} = -mgh = -(8)(9.81)(0.8)$$
$$= -62.784$$

$$T_A = \tfrac{1}{2} m k^2 = \frac{1}{2}(8)(0.22)^2 = 0.1936$$

$$V_{g_B} = -(8)(9.81)(0.8) = -62.784$$

$$T_B = \frac{1}{2} m V^2 = \frac{1}{2}(12) V^2 = 6 V^2$$

$$0 = 6V^2 + 0.1936 - 62.784 - 62.784$$
$$V = 11.20 \text{ m/s}$$